

NEMATODES FROM PAPUA NEW GUINEAN SNAKES

H. I. JONES
Department of Parasitology,
University of Queensland.

ABSTRACT

The nematodes *Kalicephalus enygri*, *K. novaebritanniae*, *Abbreviata oligopapillata* and *Abbreviata kaulensis* n.sp. were recovered from snakes collected on Karkar Island, Papua New Guinea. The coexistence of two *Kalicephalus* species within the oesophagus of the same host is reported for the first time, and their differentiation and the probable means by which they ensure reproductive isolation are described. The snakes *Enygrus asper*, *Acanthophis antarcticus* and *Stegonotus modestus* are new host records for *K. novaebritanniae*, and *A. antarcticus* is a new host record for *A. oligopapillata*.

There have been few reports of the parasites of reptiles from Papua New Guinea. This paper reports the nematodes recovered from 16 snakes collected around Kaul village, Karkar Island, Madang Province, in January 1970, viz., *Stegonotus modestus* (2), *Enygrus asper* (6), *Enygrus carinatus* (4), *Acanthophis antarcticus* (1), *Boiga irregularis* (1) and *Dendrelaphis punctulatus* (2). These were killed with ether and preserved in 70% alcohol. Removed worms were stored in 70% alcohol with glycerine and transferred to chlorolactophenol for examination.

RESULTS

Order: STRONGYLIDA

Superfamily: DIAPHANOCEPHALOIDEA

Kalicephalus enygri Kreis 1940

MATERIAL EXAMINED: 42♂ 54♀, QM G11771; 7♂ 9♀, QM G11772; 12♂ 17♀, QM G11773; 44♂ 52♀, QM G11774; 38♂ 39♀, QM G11775, from oesophagi of *E. asper* QM J28755, J28758, J28751, J28756 and J28757 respectively; 10♂ 17♀, QM G11776; 4♂ 5♀, QM G11777; 1♂ 4♀, QM G11778; 1♂ 2♀, QM G11779, from oesophagi of *E. carinatus* QM J28752, J28753, J28754 and J28760 respectively.

Worms were recovered from the oesophagus, usually the upper 5 cm, of five of the six *E. asper* ($\bar{x} \pm s = 63 \pm 17$ worms per snake) and all four *E. carinatus* ($\bar{x} \pm s = 11 \pm 4$ worms per snake). Females were slightly more common than males,

but no size differences from the two hosts were detected.

Kalicephalus novaebritanniae Baylis 1927

MATERIAL EXAMINED: 13♂ 6♀, QM G11780; 1♂ 3♀, QM G11781; 10♂ 9♀, QM G11782; 13♂ 5♀, QM G11783; 22♂ 33♀, QM G11784, from oesophagi of *E. asper* QM J28755, J28758, J28751, J28756, and J28757 respectively; 1♂ 4♀, QM G11785, lower oesophagus *A. antarcticus* QM J28764; 1♂ 5♀, QM G11786, upper small intestine *S. modestus* QM J28761.

Worms were recovered from five of the six *E. asper* ($\bar{x} \pm s = 23 \pm 9$ worms per snake), from the *A. antarcticus* (five worms) and from one of two *S. modestus* (six worms). Worms from *E. asper* were found in the oesophagus, mainly in the anterior region with *K. enygri*, whereas those from *A. antarcticus* were in the lower oesophagus and those from *S. modestus* in the upper small intestine. Females were slightly more common than males, but no marked size differences from these three hosts were detected.

In the series measured from *E. asper* (QM J28757) the maximum body width and head capsule diameter were less than in either Schad's (1962) or Maplestone's (1931) measurements, whereas all other measurements were intermediate between theirs. The vulval ratio was greater in this series than in Schad's, probably a reflection of the generally greater length of these specimens.

Both *K. enygri* and *K. novaebritanniae* were recovered from the same hosts. Comparative

measurements of the species were made on 131 worms recovered from *E. asper* (QM J28757), Table 1, and these show that *K. novaebritanniae* were consistently larger than *K. enygri*, significantly so in lengths of spicules, vagina and tail and in the vulva ratio. In *K. novaebritanniae* the vulva was on a retractable peduncle and was consistently further posterior than in *K. enygri*, where it was on a slight elevation. All *K. enygri* females were amphidelphic, whereas in all *K. novaebritanniae* the uteri were opposed as they left the ovijectors, but the posterior uterus then turned anteriorly, extending far past the anterior end of the anterior ovijector. Overlap was apparent in the shape of the anterior chitinous ridge, and worm lengths, maximum head diameter, buccal capsule depth, and ratio of oesophagus length to oesophagus bulb diameter.

DISCUSSION

Schad (1956) showed that the *Kalicephalus* species *K. agkistrodontis*, *K. parvus* and *K. rectiphilus* occupied different sites within the host *Coluber constrictor*. The shape of the posterior ventral chitinous plate, disposition of the uteri, position of the vulva and length of the spicules and vagina made differentiation of the two species within New Guinea snakes simple. The greater vaginal length and spicule length in *K. novaebritanniae* without any overlap between the two species must preclude interbreeding, and are assumed to be the mechanism by which genetic isolation is ensured. Sprent (1977) has recently reported a similar situation where pairs of species of ascaridoid nematodes exist together in the same organ in the same python hosts; spicule and vagina lengths are the features precluding hybridization.

K. enygri was described by Kreis (1940) from *E. asper* collected from New Britain, and it has

since been reported from *E. carinatus*, *A. antarcticus*, *Denisonia superba* and *Varanus indicus*. The measurements of *K. enygri* from *E. asper* in the present study were, in almost all respects, similar to those from *E. carinatus* from the Solomon Islands and those from *A. antarcticus* and *D. superba* from Australia (Schad 1962). All the worms found in this study, however, were amphidelphic (with a similar vulval ratio to those from *E. carinatus*). Specimens from Australian hosts were prodelphic with the vulva further posterior and consequently a higher vulval ratio.

K. novaebritanniae has previously been recorded from *Boiga irregularis*, *Ptyas mucosus* and *Naja naja* from New Britain and India. The three hosts recorded in this paper are therefore new host records. The measurements of this species recorded by Schad (1962) from *B. irregularis* from New Britain and Maplestone's measurements from *P. mucosus* and *N. naja* in the Calcutta Zoo (Maplestone, 1931) indicate that this is a species which shows much geographical or host-dependent variation. In the present study the posterior ventral chitinous plate was less markedly triangular than in Schad's description, although distinctive from the lunate plate of *K. enygri* in almost all individuals. Further studies on specimens from other areas, and from other hosts, would be valuable in elucidating the systematics in this species.

The position of *K. novaebritanniae* in the three hosts varied: those from *E. asper* were from the upper oesophagus, from *A. antarcticus* from the lower oesophagus and from *S. modestus* from the upper small intestine. The presence of this worm in five of six *E. asper*, but its absence from all four *E. carinatus* (all of which were infected with *K. enygri*) from the same neighbourhood, suggest

TABLE 1: MEASUREMENTS (IN MM) OF *KALICEPHALUS ENYGR*I AND *K. NOVAE-BRITANNIAE* FROM *ENGYRUS ASPER*.

	<i>K. enygri</i>	<i>K. novaebritanniae</i>	P
	38♂ and 38♀ $\bar{x} \pm s$	22♂ and 33♀ $\bar{x} \pm s$	
Maximum width, male	0.17 ± 0.015	0.19 ± 0.017	<0.1
Maximum width, female	0.21 ± 0.017	0.24 ± 0.020	<0.1
Oesophagus length, male	0.32 ± 0.020	0.34 ± 0.010	<0.1
Oesophagus length, female	0.34 ± 0.020	0.39 ± 0.028	<0.05
Oesophagus width, male	0.13 ± 0.010	0.14 ± 0.007	<0.1
Oesophagus width, female	0.15 ± 0.010	0.17 ± 0.010	<0.1
Spicules	0.24 ± 0.020	0.37 ± 0.03	<0.001
Vulva ratio	2.45 ± 0.20	4.59 ± 0.39	—
Vagina length	0.08 ± 0.007	0.15 ± 0.01	<0.001
Tail length	0.29 ± 0.030	0.42 ± 0.05	<0.001

that the latter snake may not be a suitable host for *K. novaebritanniae*.

Order: SPIRURIDA

Superfamily: PHYSALOPTEROIDEA

Abbreviata kaulensis n.sp.

(Table 2; Fig. 1)

MATERIAL EXAMINED

HOLOTYPE: QM G11787, male, from stomach of *Enygrus asper*, QM J28755, collected by H. I. Jones from Kaul village, Karkar Island, Madang Province, PNG, January 1970.

ALLOTYPE: QM G11788, female, from stomach of *E. asper*, QM J28757, same data as Holotype.

PARATYPES: Six specimens in poor condition from rectum of *E. asper*, QM J28758, same data as above; one male, QM G11789, same data as Holotype.

DIAGNOSIS

Blunt apical tooth on each lip. Bifid internal apical tooth, and on internoventral and internodorsal surface of each lip; eight very small denticles near the corner of each lip, and a row of about ten very small denticles between the external and internal apical teeth. Ridge bearing variable very small denticles internal to dorsal and ventral bifid teeth. Spicules dissimilar, left five times length of right, finely pointed.

DESCRIPTION

Cylindrical worms, cuticular striations transverse, males to 24 mm in length and females 42 mm with cervical collarette. Anterior end with two lateral lips, each bearing a large blunt external apical tooth with, at its internal base, a row of about 10 very small denticles and, internal to these, a single bifid tooth. Two small bifid teeth, one ventrally and one dorsally on internal surface of each lip and internal to these a roughened ridge with two inconstant minute denticles. A row of 7 or 8 small, blunt denticles extend to the mouth corners, ventrally and dorsally. Two sessile papillae and an amphid on exterior of each lip. Short muscular oesophagus, surrounded near its posterior end by a nerve ring, clearly demarcated from the wider glandular oesophagus about nine times as long. Excretory pore conspicuous, with wide excretory canal passing posteriorly towards it, posterior to origin of glandular oesophagus. Cervical papillae inconspicuous, spiked, anterior to excretory pore. Glandular oesophagus widens slightly in passing posteriorly.

TABLE 2: BODY MEASUREMENTS OF *ABBREVIATA KAULENSIS* N. SP. (IN MM)

	Holotype	Allotype
Length	21.37	28.12
Maximum width	0.37	0.49
Muscular oesophagus length	0.27	0.36
Muscular oesophagus width	0.12	0.15
Glandular oesophagus length	2.45	3.76
Glandular oesophagus width	0.20	0.32
Oesophago-intestinal junction*	3.00	4.26
Nerve ring*	0.27	—
Cervical papillae*	0.42	—
Excretory pore*	0.55	—
Vulva*	—	6.37
Eggs	—	50 × 28–31 μ
Left spicule	1246 μ	—
Right spicule	252 μ	—

* distance from anterior end.

MALE: Bursa extends just beyond tip of tail, supported by four pairs of long, pedunculated, pericloacal papillae. Three pairs of short, pedunculated, caudal papillae, approximately equally spaced. Bursa lined by rows of small tuberculations anteriorly and laterally; on the tail they are replaced posterior to cloaca by a rugose area extending as far as the central, caudal papillae; on the alae they extend beyond the fourth long papillae, decreasing in size, the rows spaced at 14 μ intervals. Two small lateral and one central sessile papillae anterior to cloaca, and two pairs of postcloacal sessile papillae.

Spicules unequal. Left about five times length of right, originating anterior to junction of seminal vesicle and ejaculatory duct, thin and sinuous, terminating in a very fine point, 1246 μ long; right stout and well chitinized, alate near tip, terminating in a blunt point.

FEMALE: Vulva situated about one quarter along the length of the body, flush with body wall. Muscular oviduct leads posteriorly to a reservoir; uterus with four branches. No uterine branches anterior to vulva. Tail pointed. Eggs elongated, smooth thick shells, embryonated, 50 × 28–31 μ.

DISCUSSION

A. kaulensis has similar eggs and spicules to *A. oligopapillata*, but is a longer worm, with seven to eight small corner lip denticles instead of the four larger ones in *A. oligopapillata*, and postcloacal bursal tuberculations replaced by a rugose area. The conformation of the lip denticles distinguishes this species from the three other species recorded from New Guinean reptiles: *A. multipapillata*, a

much larger worm with considerably longer spicules; *A. natricis*, which has no corner mouth denticles; and *A. heterocephala*, which is also without corner denticles (Kreis 1940). The distinct row of small denticles between the external and internal apical teeth distinguishes this from all recorded Australian species; in addition, *A. confusa* has a spatulate tip to the left spicule (Johnston and Mawson 1942), *A. physignathi* has larger eggs and a considerably longer left spicule (Baylis 1924), and *A. antarctica* has less inequality in the spicule lengths (Irwin-Smith 1922a). It most closely resembles *A. bancrofti*, but this species has more elongated eggs, and five pointed mouth corner denticles, instead of 7-8 small ones (Irwin-Smith 1922b).

Abbreviata oligopapillata Kreis 1940

MATERIAL EXAMINED: 1♂ 1♀ immature (stomach), 6♂ 5♀ (rectum), QM G11790, from *A. antarcticus*, QM J28764.

The worms varied from 9 to 12 mm in length, and corresponded with the description given by Kreis (1940) of specimens recovered from *Sphenomorphus jobiensis* from New Britain, although the eggs were larger, $28 \times 51 \mu$ compared

with $37 \times 22 \mu$ in Kreis' specimens. This snake had the remains of an unidentifiable lizard in the stomach, and this infection may have been a spurious one.

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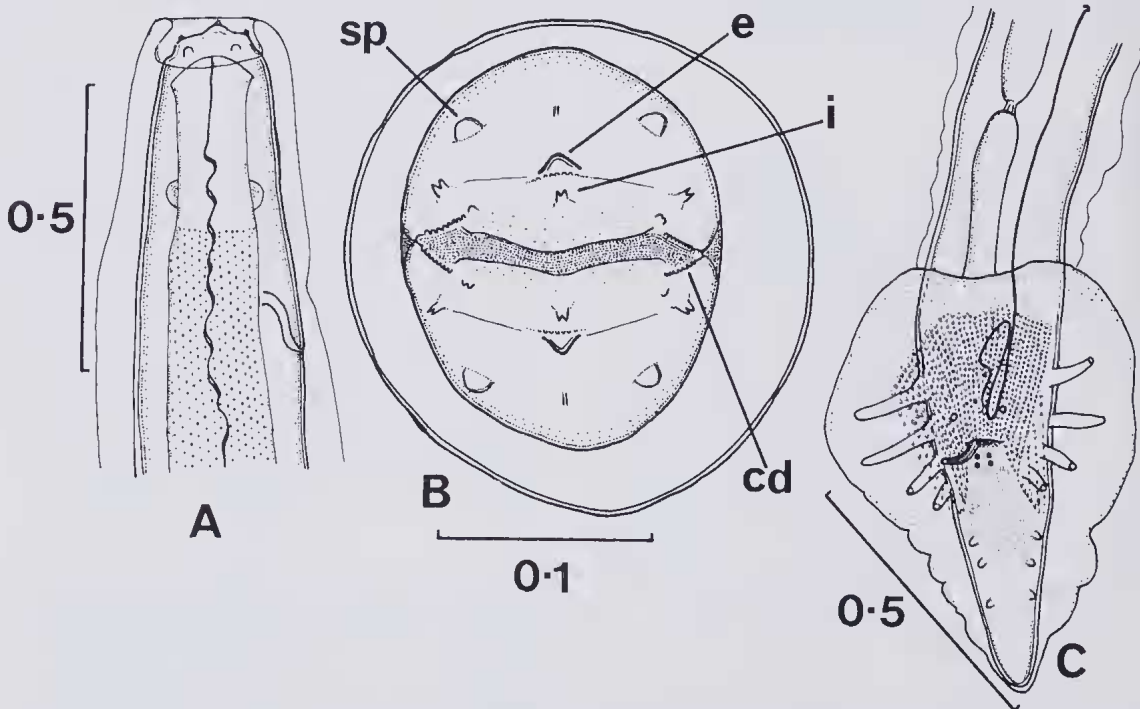


FIG. 1: *Abbreviata kaulensis*. Holotype, QM G11787. A, anterior end, lateral; B, anterior extremity, *en face* showing lateral lips; C, male bursa, ventral. (cd = mouth corner denticles, e = external apical tooth, i = internal apical tooth, sp = sessile papilla.) Measurements in mm.

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